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Aberdeen Proving Ground

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STATIC PENETRATION TESTS OF

120MM, TL53, HEAT SHELL (U)

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D. A. Project No. 504-03-050

DEVELOPMENT AND PROOF SERVICES

18th Report OCO Project No. TAL-1602

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ARMY... 00... ABERDEEN PROVING GROUND MD... 415

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DEVELOPMENT AND PROOF SERVICES
ABERDEEN PROVING GROUND
MARYLAND

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AUTHORITY: PESD No. 70405530-01-10902

Pvt. JGNelson/ncj
27 September 1957

STATIC PENETRATION TESTS OF

120MM, T153, HEAT SHELL

CODE SHEET INCLUDED

EIGHTEENTH REPORT ON ORDNANCE PROJECT NO. TAL-1602

DATES OF TEST: 25 - 27 JUNE 1957

ABSTRACT

OBJECTIVE

To determine the static penetration of standard T153E8 shell with and without the spike, and the comparative penetration of five new T153 designs.

SUMMARY

Five rounds each of 120mm, HEAT Shell (Model Numbers T153-ST14, T153-ST15, T153-ST16, T153-ST17, T153-ST18, T153-ST19, T153-ST20), were statically fired atop stacks of 28 each - 8" x 8" x 1-1/32" homogeneous armor plate to observe total penetration, hole dimensions (entrance and exit), and unusual hole patterns.

The average penetration for each design was: T153-ST14 - 17.30"; T153-ST15 - 20.07"; T153-ST16 - 17.72"; T153-ST17 - 19.72"; T153-ST18 - 18.06"; T153-ST19 - 16.96" (Std. with spike); and T153-ST20 - 17.94" (Std. without spike).

CONCLUSION

It is concluded from static firings that the T153-ST15 and T153-ST17 will produce the greatest armor penetration of the designs tested.

RECOMMENDATIONS

It is recommended that:

All seven designs be tested for dynamic penetration of armor by firing up to 2000 yards at homogeneous armor plate at predetermined degrees of obliquity.

Designs T153-ST15 and T153-ST17 be considered as having produced the greatest armor penetration (by static firing) of the designs tested.

REGRADE DATA CANNOT BE PREDETERMINED

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I INTRODUCTION

A. In 1950 Picatinny Arsenal was assigned technical supervision of the development of the 120mm, T153, HEAT round. The program was suspended in January 1956 at 80 percent completion and was resumed in August 1956 with June 1957 as the target completion date. Frankford Arsenal has since been given the technical supervision of the program; also, negotiations of a contract to complete the development have been finished.

B. The round is required to defeat 16-inch armor plate with maximum behind-the-plate effect at a range of 2000 yards. The existing problem areas are thought to be:

1. Inadequate wiring system.
2. Inadequate fuzing.
3. Inadequate "lucky" mounting system.
4. Inadequate space in spike to permit jet formation.

II DESCRIPTION OF MATERIEL

<u>Item</u>	<u>Quantity</u>	<u>Component</u>	<u>Dwg. No.</u>	<u>Remarks</u>
1	5	T153-ST20	WBSK-1342	T153E8 without Spike.
2	5	T153-ST19	WBSK-1342	T153E8 w/o tapered wire, w/spike.
3	5	T153-ST14	WBSK-1342	Large diameter spike, cemented joints.
4	5	T153-ST18	WBSK-1342	Spike large diameter, closed at nose end, all wire connections made at base of shell.
5	5	T153-ST16	WBSK-1342	Medium diameter spike, cemented joints.
6	5	T153-ST15	WBSK-1342	Same as ST16 except wire passes through cone near apex.
7	5	T153-ST17	WBSK-1342	Same as ST15 except "snap-in" cone.

Drawing No. WBSK-1342 is included as Figure 1.

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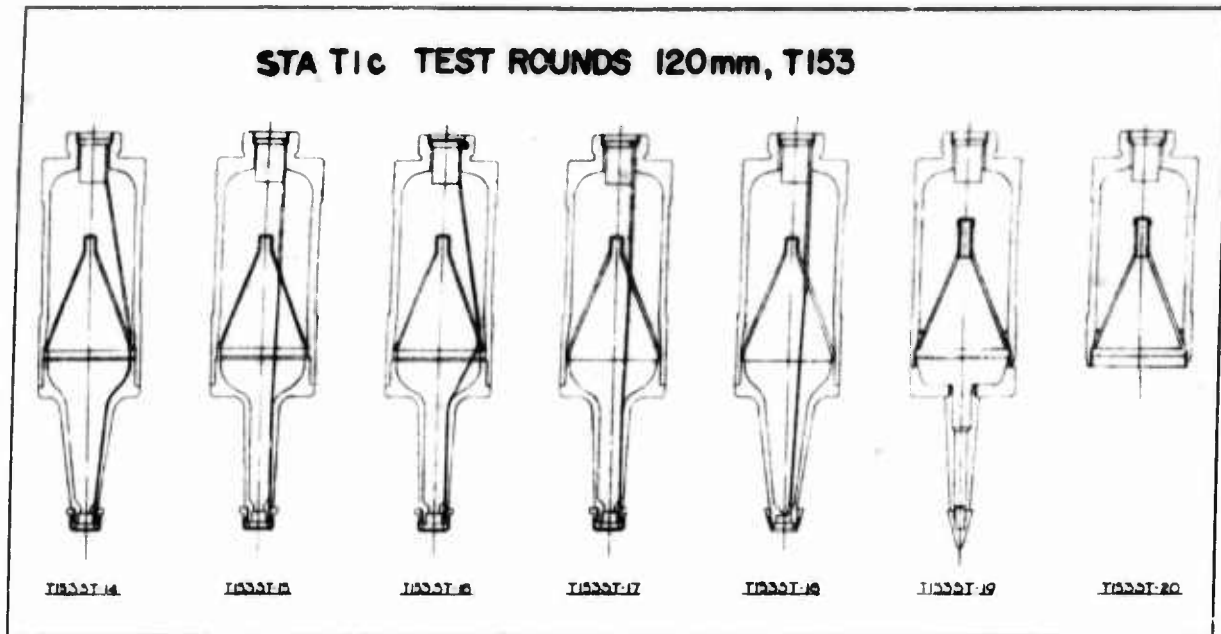


Figure 1 - Dwg. No. WBSK 1342

III DETAILS OF TEST

A. Five rounds each of the seven designs in question were set up for firing in the following manner:

1. For each round a stack of 28 each 8" x 8" x 1-1/32" homogeneous armor plate was made.

2. Cardboard tube "standoffs" were taped to the round and to the top plate of the stack to assure no "blow-over" or wobbling previous to firing.

3. The rounds were armed with Teteryl pellets 1-1/4" diameter by 1/2" high and detonated by Engineer's special blasting caps inserted in centered holes in 1-1/4" diameter by one inch high hard wood blocks.

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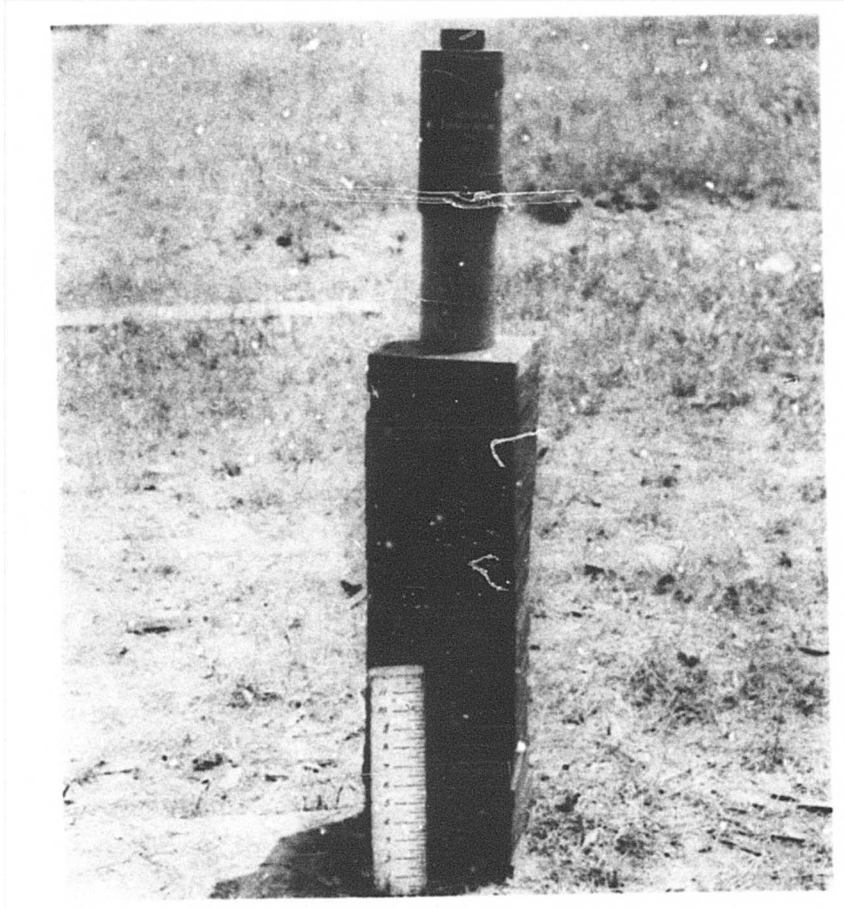


Figure 2 - B25378: Typical example of setup of subject round immediately before firing. Round is taped to cardboard stand-off tube which is taped to top plate of stack of 28 each 8"x8"x1" plates.

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B. Measurements (to the nearest 1/16") were taken of the entrance and exit hole in each plate. Observations of jet location, hole shape (unusual), and unusual occurrences were also recorded.

C. By eliminating the rounds that both showed defect upon X-Ray and produced a penetration discrepancy greater than one inch, the following average penetrations for each design tested were determined:

T153-ST14	-	17.30"
T153-ST15	-	20.07"
T153-ST16	-	17.72"
T153-ST17	-	19.72"
T153-ST18	-	18.06"
T153-ST19	-	16.96"
T153-ST20	-	17.94"

D. It should be noted that there are four different external shapes represented in the seven designs tested. Therefore, it is possible and highly probable that the aerodynamic characteristics of the four external shapes are quite different. Hence, discrepancies among the four designs in accuracy, terminal velocities, flight stability and dynamic plate penetration may be realized.

IV CONCLUSIONS

It is concluded that:

A. The T153-ST15 and T153-ST17 will produce the greatest armor penetration (by static firing) of the designs tested.

B. The average penetration of all seven designs was considered to exceed (statically) the military requirement of armor 16 inches thick.

V RECOMMENDATIONS

It is recommended that:

A. All seven designs be tested for dynamic penetration of armor by firing against homogeneous armor plate at predetermined degrees of obliquity and ranges up to 2000 yards.

B. The T153-ST15 and T153-ST17 be considered the designs producing the greatest armor penetration (by static firing) of those tested.

C. If recommendation A is not considered feasible, the following course of action is suggested:

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1. Design T153-ST15 and T153-ST17 be fabricated and tested dynamically against the T153-ST19 (reference round) for flight and penetration characteristics at suitable ranges varying between 0 and 2000 yards.

2. If tests prove designs T153-ST15 and T153-ST17 to be significantly better than the reference rounds, it is recommended that consideration be given to adopting the shell which is cheapest to manufacture for use in the 120mm Tank, M103, system.

SUBMITTED:

Robert N. Dempsey

ROBERT N. DEMPSEY
Project Engineer

Pvt J. G. Nelson

J. G. NELSON
Pvt, Ord Corps
Proof Director

REVIEWED:

H. B. Anderson

H. B. ANDERSON
Chief, Artillery
Ammunition Branch

M. O. Kaplan

for H. A. BECHTOL
Chief
Artillery Division

APPROVED:

Arthur Noble

H. A. NOBLE
Assistant to the Deputy Director
for Engineering Testing
Development and Proof Services

REFERENCES

Test Program Request No. FA-MDR-459
Frankford Arsenal, Philadelphia 37, Pa.

Experimental Data Cards

OBSERVERS

Pvt. J. Halloran	-	Frankford Arsenal
Mr. Kufermann	-	Picatinny Arsenal
Mr. Simpson	-	Code B

APPENDICES

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ORDNANCE CORPS
FRANKFORD ARSENAL Pvt JHolloran/hcm/22146
Philadelphia 37
Pennsylvania

APPENDIX A _

IN REPLY
REFER TO ORDBA-MDR

ORDBG C) 471/50 1957

14 FEB 1957

SUBJECT: 120mm T153 HEAT Round

TO: Commanding General
Aberdeen Proving Ground
Maryland

ATTENTION: D&PS

1. Inclosed is Test Program Request #FA-MDR-459 outlining a program for static tests of 120mm T153 HEAT round.

2. It is requested that this Arsenal be notified in advance of the firing of these tests in order that representatives may be present.

3. Cost of tests should be applicable to RAD on Project TAL-1602

FOR THE COMMANDER:

/s/

1 Incl
1. TPR #FA-MDR-459 (in dup)

V. W. WALTERS
Assistant

cc: OCO-ORDM, w/incl
ORDBB, Mr. Kupermann w/incl
Code A, Mr. Simpson w/incl

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Test Program Request #PA-MTR-459
Frankford Arsenal, Phila. 37, Pa.

Pvt Halloran/hcm/5156
29 January 1957

1. Material for Test:

<u>Item</u>	<u>Quantity</u>	<u>Component</u>	<u>Dwg. No.</u>	<u>Rev.</u>	<u>Remarks</u>
1	5	T153-ST19	WB3720X		T153E8w/o spike
2	5	T153-ST20	WB3720X		T153E8 w/o tapered wire w/spike
3	5	T153-ST14	WBSK1342		Large diameter spike cemented joints
4	5	T153-ST16	WBSK1342		Medium diameter spike cemented joints
5	5	T153-ST15	WBSK1342		Same as ST16 except wire passes through cone near apex
6	5	T153-ST17	WBSK1342		Same as ST16 but with "snap-in" cone
7	5	T153-ST18	WBSK1342		Spike closed at nose end, all wire connections made at base of shell

2. Project Authority:

- (a) Project No. TA1-1602
- (b) PESD No. 70405530-01-10902

3. Arsenal Expenditure Order No.

64734-03

4. Object of Development:

To develop a 120mm HEAT round for the T123 gun.

5. History Sketch:

The development of this shell was initiated in 1950 with the technical supervision assigned to Picatinny Arsenal and the development contract awarded to Code A. The program was suspended in January 1956 at 80% completion and then reinstated in August 1956 with a target completion date of June 1957. Since the reinstatement of the project, Frankford Arsenal has been given the technical supervision and at this date the negotiations of a contract with Code A to complete the subject development have just been completed.

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Test Program Request #FA-MTR-459
Frankford Arsenal, Phila. 37, Pa.

The requirements of this round are to defeat 16" of armor with maximum behind-the-plate effect at a range of 2000 yards with a probable error of .2 mils vertical and horizontal. At the present time the problem areas are thought to be as follows:

- (1) The wiring system is inadequate
- (2) The fusing may be inadequate
- (3) The lucky mounting system is inadequate
- (4) The space in the spike to permit jet formation is inadequate

The accuracy of this round is satisfactory and the development program now being undertaken will be an attempt to improve the terminal ballistics and round dependability without impairing accuracy. This static test is the first under the present program and will be fired in an attempt to determine the optimum spike configuration for penetration.

6. Description of Changes Made Since Last Proving Ground Test:

Items 1 and 2 of section (1) of this request are the present T153E8 Design with and without the spike attached, both being without the tapered wire and lucky assembly of the complete round.

Item 3, the T153-ST14, is the same shell with a tapered spike of much larger diameter than the standard and with a cemented joint between the body and spike and between the locking ring and body replacing the present threaded joints. This design also includes a packed lucky with the wire being carried in a flexible conduit through the explosive charge.

Item 4, T153-ST16, is the same as ST14 except that the spike is of an intermediate diameter between ST14 and the present E8 spike.

Item 5, T153-ST15, is the same as ST16 except that the wire passes through the cone and explosive charge close to the longitudinal axis of the shell.

Item 6, T153-ST17, is the same as ST16 except that it is equipped with a "snap-in" cone which is seated on the spike rather than in the body.

Item 7, T153-ST18, has a spike which is closed at the nose and a wiring system in which all wire connections are made at the base of the shell.

7. Local Tests:

None

8. Object of Test:

To determine the static penetration of the standard T153E8 round with and without the spike and of the five new designs.

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Test Program Request #PA-MIR-459
Frankford Arsenal, Phila 37, Pa

9. Precautions in Handling and Testing:

Normal handling of live loaded rounds for static firings.

10. Recommended Test Program:

Fire all static devices in a vertical position against approximately twenty-eight inches of stacked homo-armor plate. The top five plates shall be at least 8"x 8" square to provide a suitable jet entry area, and the remaining plates shall be 6"x 6" minimum. The following data should be recorded:

- (a) Total penetration
- (b) Size of entrance and exit hole at each plate
- (c) Any unusual hole pattern

The shell as received will be comp B loaded with a formed base element cavity, for functioning of the shell, the system shown in PX-13-1317, previously furnished the proving ground, should be used as a guide. Corps of engineers special electric blasting caps should be used for this test.

This test may be altered at the discretion of the proof officer, with the consent of the Project Engineer.

11. Coordination:

- (a) Chief of Ordnance (ORDTA)
- (b) Picatinny Arsenal
- (c) Aberdeen Proving Ground
- (d) Code A
- (e) Frankford Arsenal

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ROUND-BY-ROUND DATA

APPENDIX B

STATIC TESTS OF 120MM T153 HEAT SHELL

All Plate Measurements Given are in Inches

Each Plate is 1-1/32" Thick

PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
	T153 - ST14-1		
1	2-1/4 x 2-1/8	1-7/8 x 1-7/8	Indentation on entrance side of No.1 - 4-1/2 x 3-9/16 x 5/16" deep, circumferential to hole. Jet in No.5 - 2-1/2" \perp entrance; 2-1/4" \perp exit.
2	1-9/16 x 1-9/16	1-5/16 x 1-5/16	
3	1-5/16 x 1-1/4	1-1/8 x 1-1/16	
4	1-1/4 x 1-3/16	1-1/8 x 1-1/8	
5	1-1/8 x 1	1-3/16 x 1-1/8	
6	1-1/8 x 1-1/16	15/16 x 7/8	
7	7/8 x 7/8	13/16 x 3/4	
8	3/4 x 11/16	3/4 x 11/16	
9	5/8 x 5/8	9/16 x 1/2	
10	5/8 x 9/16	9/16 x 9/16	
11	1/2 x 1/2	9/16 x 1/2	Jet in No.13 - 1" \perp exit. Cu trace on entrance of No. 21.
12	7/16 x 7/16	5/8 x 9/16	
13	1/2 x 7/16	9/16 x 1/2	
14	3/8 x 3/8	7/16 x 3/8	
15	7/16 x 7/16	3/8 x 5/16	
16	3/8 x 5/16	1/2 x 7/16	
17	7/16 x 7/16	7/16 x 3/8	
18	7/16 x 3/8	9/16 x 1/2	
19	1/2 x 7/16	7/16 x 3/8	
20	7/16 x 3/8	13/16 x 3/4	
21			
	T153 - ST14-2		
1	2-5/16 x 2-1/4	2-1/4 x 2-1/8	Indentation on edge of hole 3/4"x 1-3/4"x 7/16 deep on entrance of No. 1. Jet in No.6 - 3-3/16" \perp entrance; 1-5/8" \perp exit.
2	1-3/4 x 1-3/4	1-9/16 x 1-1/2	
3	1-7/16 x 1-7/16	1-5/16 x 1-1/4	
4	1-3/8 x 1-5/16	1-1/4 x 1-3/16	
5	1-3/16 x 1-1/8	1-1/4 x 1-3/16	
6	1-1/4 x 1-3/16	1-1/8 x 1	
7	15/16 x 7/8	3/4 x 11/16	
8	3/4 x 3/4	11/16 x 9/16	
9	11/16 x 5/8	11/16 x 5/8	
10	5/8 x 9/16	5/8 x 5/8	
11	9/16 x 1/2	9/16 x 1/2	
12	9/16 x 7/16	1/2 x 1/2	
13	1/2 x 7/16	7/16 x 3/8	
14	7/16 x 7/16	9/16 x 1/2	
15	7/16 x 5/16	7/16 x 3/8	
16	7/16 x 3/8	7/16 x 3/8	

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PLATE NO.	HOLE MEASUREMENTS						OBSERVATIONS
	Diameter - Inches						
	Entrance			Exit			
17	7/16	x	3/8	7/16	x	3/8	
18	7/16	x	5/16	9/16	x	1/2	
19	5/8	x	9/16	13/16	x	3/4	
20							Cu trace on No. 20.

T153 - ST14-3

1	2 x 2	2 x 1-3/4	Indentation on edge of hole
2	1-5/8 x 1-1/2	1-3/8 x 1-5/16	5/8"x 1"x 1/2 deep on ent.
3	1-7/16 x 1-5/16	1-3/4 x 1-1/4	of No. 1.
4	1-1/4 x 1-1/4	1-1/8 x 1-1/16	Indentation on edge of hole
5	1-1/8 x 1-1/16	1 x 1	1"x 1/2"x 7/16 deep on ent.
6	1 x 15/16	15/16 x 7/8	of No. 1.
7	13/16 x 11/16	7/8 x 13/16	
8	11/16 x 11/16	3/4 x 11/16	Jet in No. 5 - 2-1/16" ⊥
9	9/16 x 1/2	5/8 x 5/8	ent.; 3-15/16" ⊥ exit.
10	9/16 x 9/16	5/8 x 5/8	
11	9/16 x 1/2	9/16 x 9/16	
12	1/2 x 1/2	9/16 x 9/16	
13	1/2 x 7/16	1/2 x 7/16	
14	1/2 x 7/16	1/2 x 7/16	Hole in No. 18 - 13/16 deep
15	1/2 x 7/16	7/16 x 3/8	Bulge on exit of No. 18 with
16	1/2 x 7/16	9/16 x 3/8	1/2" long crack.
17	1/2 x 5/16	3/4 x 5/8	
18	11/16 x 9/16		

T153 - ST14-4

1	2-1/8 x 2	1-7/8 x 1-3/4	Indentation circumferential
2	2 x 1-7/8	1-7/8 x 1-3/4	to hole ent. No. 1
3	1-3/4 x 1-3/4	1-3/8 x 1-1/8	3-3/8"x 3-1/2"x 5/16" deep.
4	1-1/8 x 1-1/16	1 x 5/8	
5	15/16 x 3/4	7/8 x 3/4	Jet in No. 5 - 2-1/2" ⊥
6	7/8 x 3/4	7/16 x 5/8	ent.; 2" ⊥ exit.
7	13/16 x 9/16	3/4 x 11/16	
8	5/16 x 1/2		Hole in No. 8 - 7/8" deep.

T153 - ST14-5

1	2-1/4 x 2-1/4	1-7/8 x 1-1/2	Indentation circumferential
2	1-1/2 x 1-5/16	1-1/4 x 1-1/4	to hole ent. No. 1 -
3	1-5/16 x 1-1/4	1-1/4 x 1-3/16	2-3/4"x 2-3/4"x 1/4" deep.
4	1-1/4 x 1-1/8	1-3/16 x 1-1/8	
5	7/8 x 7/8	7/8 x 7/8	Jet in No. 4 - 2-1/4" ⊥
6	13/16 x 3/4	3/4 x 3/4	ent.; 3-1/4" ⊥ exit.
7	5/8 x 5/8	5/8 x 7/16	
8	5/8 x 7/16	11/16 x 5/8	

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PLATE NO.	HOLE MEASUREMENTS				OBSERVATIONS
	Diameter - Inches				
	Entrance		Exit		
9	9/16	x 1/2	9/16	x 1/2	
10	1/2	x 1/2	1/2	x 1/8	Jet in No. 13 - 1-3/8" \perp
11	1/2	x 7/16	9/16	x 9/16	ent.
12	1/2	x 1/2	9/16	x 1/2	
13	1/2	x 1/2	7/16	x 3/8	
14	7/16	x 3/8	1/2	x 1/2	Hole in No. 20 - 1/4" deep.
15	3/8	x 3/8	7/16	x 7/16	
16	3/8	x 3/8	7/16	x 1/2	
17	1/2	x 7/16	7/16	x 7/16	
18	7/16	x 7/16	9/16	x 1/2	
19	9/16	x 7/16	1/2	x 1/2	
20	1/2	x 5/16			

T153 - ST15-1

1	2-1/8	x 2	1-7/8	x 1-3/4	Indentation circumferential to hole ent. No. 1 - 3-1/2" x 3-3/4" x 7/16" deep.
2	1-11/16	x 1-11/16	1-1/2	x 1-11/16	
3	1-3/16	x 1-1/8	1-1/4	x 1-1/4	
4	1-3/16	x 1-1/8	1-1/8	x 1-1/8	
5	1-1/8	x 1-1/8	1-1/16	x 1-1/16	Jet in No. 6 - 3-1/2" \perp
6	1-3/16	x 1-1/16	7/8	x 3/4	ent.; 2" \perp exit.
7	7/8	x 13/16	3/4	x 11/16	
8	3/4	x 5/8	11/16	x 5/8	
9	5/8	x 9/16	5/8	x 9/16	Jet in No. 16 - 3/4" \perp
10	5/8	x 5/8	9/16	x 9/16	ent.; 1" \perp exit.
11	9/16	x 1/2	9/16	x 9/16	
12	9/16	x 9/16	5/8	x 9/16	
13	5/8	x 9/16	9/16	x 9/16	Hole in No. 20 - 5/8" deep.
14	9/16	x 1/2	9/16	x 1/2	
15	1/2	x 7/16	1/2	x 1/2	Slight bulge on exit
16	1/2	x 7/16	9/16	x 9/16	of No. 20.
17	3/8	x 3/8	3/8	x 5/16	
18	5/16	x 5/16	1/2	x 1/2	
19	7/16	x 7/16	1/2	x 1/2	
20	11/16	x 1/2			

T153 - ST15-2

1			2	x 1-1/2	Splice still in No. 1.
2	1-1/2	x 1-3/8	1-7/16	x 1-1/4	Splice extended 3/4" \perp
3	1-1/2	x 1-7/16	1-1/4	x 1-1/4	exit No. 1.
4	1-1/8	x 1-1/8	1-1/8	x 1-1/8	
5	1-1/8	x 1	1-1/8	x 1-1/16	Jet in No. 6 - 3-3/8" \perp
6	1-1/4	x 1-1/8	7/8	x 11/16	ent.; 2-1/4" \perp exit.
7	3/4	x 3/4	3/4	x 3/4	
8	11/16	x 11/16	11/16	x 11/16	
9	5/8	x 5/8	5/8	x 9/16	Jet in No. 16 - 3/8" \perp
10	9/16	x 9/16	9/16	x 9/16	ent.; 1" \perp exit.

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PLATE NO.	HOLE MEASUREMENTS						OBSERVATIONS
	Diameter - Inches						
	Entrance			Exit			
11	9/16	x	9/16	5/8	x	9/16	Hole in No. 20 - 1/16" deep
12	9/16	x	9/16	9/16	x	1/2	
13	9/16	x	1/2	9/16	x	9/16	
14	9/16	x	1/2	1/2	x	1/2	
15	1/2	x	7/16	7/16	x	7/16	
16	3/8	x	3/8	3/8	x	3/8	
17	7/16	x	3/8	7/16	x	3/8	
18	7/16	x	3/8	1/2	x	7/16	
19	9/16	x	1/2	9/16	x	1/2	
20	1/2	x	1/2				

T153 - ST15-3

1	2-3/16	x	2-1/8	1-1/2	x 1-3/16	Jet in No. 5 - 3-3/16" \perp ent.; 2-3/4" \perp exit.
2	1-1/4	x	1-1/8	1-3/8	x 1-3/8	
3	1-5/16	x	1-1/8	1-1/4	x 1-3/16	Jet in No. 15 - 3/4" \perp ent.; 1/2" \perp exit.
4	1-1/4	x	1-1/4	1-3/16	x 1-3/16	
5	1-5/16	x	1-1/4	7/8	x 3/4	
6	3/4	x	11/16	11/16	x 5/8	
7	5/8	x	9/16	5/8	x 9/16	Hole in No. 18 - 9/16" deep.
8	11/16	x	5/8	5/8	x 9/16	
9	9/16	x	1/2	9/16	x 9/16	Bulge on No. 18 exit.
10	1/2	x	1/2	9/16	x 1/2	
11	7/16	x	3/8	9/16	x 9/16	
12	7/16	x	3/8	1/2	x 1/2	
13	1/2	x	1/2	1/2	x 1/2	
14	7/16	x	7/16	1/2	x 1/2	
15	1/2	x	7/16	5/8	x 1/2	
16	1/2	x	7/16	1/2	x 7/16	
17	9/16	x	3/8	11/16	x 9/16	
18	9/16	x	3/8			

T153 - ST15-4

1	2-1/4	x	2-1/8	1-7/8	x 1-3/4	Jet in No. 5 - 2-1/2" \perp ent.; 4" \perp exit.
2	1-13/16	x	1-1/2	1-5/16	x 1-3/16	
3	1-1/4	x	1-1/4	1-1/4	x 1-1/4	Jet in No. 16 - 1/4" \perp ent.; 5/8" \perp exit.
4	1-1/4	x	1-3/16	1-3/16	x 1-1/8	
5	1-1/8	x	1-1/8	1	x 15/16	
6	1	x	7/8	7/8	x 3/4	
7	3/4	x	3/4	3/4	x 11/16	
8	5/8	x	5/8	3/8	x 9/16	Hole in No. 20 - 1" deep.
9	9/16	x	9/16	9/16	x 9/16	
10	1/2	x	1/2	9/16	x 1/2	Bulge on No. 20 exit.
11	1/2	x	7/16	1/2	x 1/2	
12	1/2	x	1/2	1/2	x 7/16	
13	1/2	x	7/16	9/16	x 7/16	
14	9/16	x	1/2	1/2	x 7/16	

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
15	7/16 x 7/16	9/16 x 1/2	
16	1/2 x 7/16	3/8 x 3/8	
17	3/8 x 3/8	1/2 x 5/16	
18	7/16 x 3/8	7/16 x 3/8	
19	1/2 x 7/16	3/4 x 1/2	
20	5/8 x 1/2		

T153 - ST15-5

1		1-7/8 x 1-3/4	Spike still in No. 1.
2	1-3/4 x 1-3/4	1-1/4 x 1-3/16	Spike extends 1-13/16" \perp
3	1-1/4 x 1-5/16	1-1/4 x 1-3/16	exit No. 1.
4	1-3/16 x 1-1/8	1-1/8 x 1-1/8	Jet in No.6 - 3-1/2" \perp
5	1-3/16 x 1-1/8	1-3/16 x 1-1/8	ent.; 2-3/4" \perp exit.
6	1-1/8 x 1-1/8	1 x 15/16	
7	13/16 x 3/4	3/4 x 11/16	
8	3/4 x 3/4	11/16 x 5/8	Jet in No.11 - 1/8" \perp
9	11/16 x 5/8	9/16 x 9/16	ent.
10	9/16 x 9/16	9/16 x 9/16	
11	9/16 x 1/2	9/16 x 9/16	Jet in No.15 - 7/8" \perp
12	1/2 x 7/16	5/8 x 5/8	exit.
13	9/16 x 1/2	1/2 x 7/16	
14	1/2 x 7/16	1/2 x 7/16	Cu trace on No.20 ent.
15	9/16 x 1/2	9/16 x 1/2	
16	3/8 x 3/8	3/8 x 5/16	
17	3/8 x 5/16	7/16 x 5/16	
18	7/16 x 3/8	1/2 x 7/16	
19	9/16 x 1/2	1/2 x 3/8	
20			

T153 - ST16-1

1	2-1/4 x 2-1/8	2 x 1-3/4	Indentation circumferential
2	1-1/2 x 1-3/8	1-5/16 x 1-3/8	to ent.hole No.1 -
3	1-1/4 x 1-1/4	1-1/4 x 1-3/16	3-9/16" x 2-7/8" x 5/16"
4	1-1/4 x 1-1/8	1 x 1	deep.
5	1 x 1	1 x 15/16	Jet in No.5 - 3" \perp ent.;
6	1 x 7/8	13/16 x 11/16	2-5/8" \perp exit.
7	3/4 x 11/16	11/16 x 5/8	
8	5/8 x 5/8	9/16 x 9/16	Jet in No.14 - 3/8" \perp
9	9/16 x 1/2	1/2 x 1/2	ent.
10	1/2 x 1/2	1/2 x 1/2	
11	1/2 x 7/16	5/8 x 9/16	Jet in No.18 - 7/8" \perp
12	9/16 x 3/8	1/2 x 7/16	ent.; 5/8" deep in plate.
13	1/2 x 7/16	7/16 x 7/16	
14	9/16 x 3/8	1/2 x 7/16	
15	1/2 x 7/16	7/16 x 7/16	Slight bulge on exit
16	7/16 x 7/16	7/16 x 3/8	No. 18

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
17	1/2 x 7/16	9/16 x 1/2	
18	11/16 x 9/16		

T153 - ST16-2

1	1-3/4 x 1-1/4	1-1/4 x 1-1/4	Spike broke up in hole No.1
2	1-3/8 x 1-5/16	1-3/16 x 1-3/16	
3	1-3/16 x 1-1/16	1-3/16 x 1-1/8	Jet in No.4 - 2-1/2" \perp ent.; 4-3/4" \perp exit.
4	1-1/8 x 1-1/8	1 x 1	
5	1 x 7/8	3/4 x 11/16	Hole in No.16 - 5/16" deep.
6	3/4 x 5/8	3/4 x 3/4	
7	11/16 x 11/16	9/16 x 1/2	
8	1/2 x 1/2	1/2 x 3/8	
9	5/8 x 9/16	5/8 x 9/16	
10	9/16 x 9/16	9/16 x 1/2	
11	9/16 x 1/2	11/16 x 1/2	
12	13/16 x 1/2	1/2 x 1/2	
13	1/2 x 7/16	1/2 x 7/16	
14	7/16 x 3/8	9/16 x 1/2	
15	1/2 x 7/16	9/16 x 5/16	
16	9/16 x 9/16		

T153- ST16-3

1			Spike left in No.1 hole. Pieces of Cu left in spike.
2	1-3/4x 1-5/8	1-5/16 x 1-3/16	
3	1-5/16 x 1-3/16	1-5/16 x 1-1/4	Jet in No.6 - 3-1/4" \perp ent.; 2-1/4" \perp exit.
4	1-3/8 x 1-3/8	1-3/16 x 1-3/16	
5	1-1/4 x 1-1/8	1-1/8x 1-1/16	Jet in No.16 - 9/16" \perp ent.; 3/4" \perp exit.
6	1-1/8 x 1	1 x 7/8	
7	1 x 15/16	13/16 x 3/4	Piece of Cu 1-3/8"x 1-3/4" x 1/4 thk.on exit No.18
8	13/16 x 11/16	11/16 x 5/8	
9	11/16 x 5/8	5/8 x 9/16	Hole No.19 - 7/16" deep.
10	5/8 x 9/16	5/8 x 9/16	
11	9/16 x 1/2	9/16 x 1/2	
12	1/2 x 1/2	9/16 x 1/2	
13	9/16 x 1/2	9/16 x 1/2	
14	1/2 x 1/2	1/2 x 1/2	
15	1/2 x 3/8	1/2 x 1/2	
16	7/16 x 3/8	9/16 x 9/16	
17	9/16 x 1/2	3/8 x 3/8	
18	7/16 x 7/16	3/4 x 11/16	
19	1-1/16 x 1		

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
<u>T153 - ST16-4</u>			
1		2 x 1-3/4	Jet in No.1 - 1-13/16" \perp
2	1-1/2 x 1-7/16	1-1/4 x 1-1/4	ent.
3	1-1/4 x 1-1/8	1-1/4 x 1-3/16	
4	1-3/16 x 1-1/8	1-3/16 x 1-1/16	Jet in No.4 - 3-1/8" \perp
5	1-1/8 x 1-1/16	7/8 x 7/8	ent.; 2-1/8" \perp exit.
6	7/8 x 13/16	7/8 x 13/16	
7	15/16 x 7/8	11/16 x 11/16	Hole in No.17 - 11/16" deep
8	11/16 x 5/8	5/8 x 5/8	
9	5/8 x 5/8	5/8 x 9/16	Bulge on exit No. 17.
10	5/8 x 9/16	11/16 x 5/8	
11	5/8 x 9/16	9/16 x 9/16	
12	9/16 x 1/2	5/8 x 5/8	
13	1/2 x 1/2	7/16 x 7/16	
14	7/16 x 3/8	7/16 x 3/8	
15	7/16 x 7/16	9/16 x 5/16	
16	7/16 x 7/16	9/16 x 1/2	
17	7/16 x 7/16		
<u>T153 - ST16-5</u>			
1	1-3/4 x 1-9/16	1-7/8 x 1-1/2	
2	1-5/8 x 1-1/2	2 x 1-7/8	Jet in No.6 - 3-1/4" \perp
3	1-5/16 x 1-3/16	1-1/4 x 1-3/16	ent.; 1-13/16" \perp exit.
4	1-5/16 x 1-3/16	1-1/8 x 1-1/8	
5	1-1/4 x 1	1-1/16 x 1	Jet in No.13 - 5/16" \perp
6	1-1/8 x 1-1/16	1-1/16 x 1	ent.
7	1 x 1	7/8 x 3/4	
8	13/16 x 3/4	11/16 x 5/8	Jet in No.14 - 7/8" \perp
9	11/16 x 5/8	11/16 x 1/2	exit.
10	5/8 x 9/16	9/16 x 1/2	
11	1/2 x 1/2	9/16 x 9/16	Hole in No.18 - 15/16"
12	5/8 x 9/16	5/8 x 5/8	deep.
13	9/16 x 9/16	1/2 x 1/2	
14	7/16 x 1/2	1/2 x 1/2	Bulge on exit No. 18.
15	9/16 x 1/2	9/16 x 1/2	
16	1/2 x 7/16	5/8 x 9/16	
17	9/16 x 1/2	3/8 x 3/8	
18	3/4 x 5/8		
<u>T153 - ST17-1</u>			
1			Spike left in No.1
2	1-3/4 x 1-5/8	1-1/2 x 1-1/2	
3	1-3/4 x 1-3/8	1-5/8 x 1-3/8	Jet in No.6 - 3-3/4" \perp
4	1-1/4 x 1-1/4	1-1/4 x 1-3/16	ent.; 2" \perp exit.
5	1-3/16 x 1-1/8	1-1/16 x 1	

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PIATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
6	1-1/8 x 1	7/8 x 13/16	Jet in No.10 - 7/16" \perp exit.
7	7/8 x 13/16	3/4 x 5/8	
8	3/4 x 5/8	5/8 x 9/16	
9	5/8 x 5/8	9/16 x 9/16	Jet in No.12 - 9/16" \perp ent.
10	5/8 x 1/2	11/16 x 9/16	
11	5/8 x 9/16	9/16 x 1/2	Cu Trace on ent. No. 20.
12	9/16 x 1/2	1/2 x 1/2	
13	1/2 x 1/2	1/2 x 1/2	
14	7/16 x 7/16	9/16 x 1/2	
15	1/2 x 3/8	1/2 x 7/16	
16	3/8 x 3/8	9/16 x 7/16	
17	7/16 x 3/8	7/16 x 3/8	
18	7/16 x 3/8	5/8 x 7/16	
19	5/8 x 1/2	7/16 x 3/8	
20			

T153 - ST17-2

1	1-15/16 x 1-3/4	2-1/2 x 2-3/8	Jet in No.5 - 1-3/4" \perp ent.; 4" \perp exit.
2	1-3/4 x 1-1/4	1-1/2 x 1-1/8	
3	1-3/16 x 1-1/8	1-1/8 x 1-1/8	
4	1-1/8 x 1	1-1/8 x 1-1/16	Jet in No.11 - 5/16" \perp ent.
5	1-1/16 x 1-1/16	1 x 15/16	
6	15/16 x 13/16	7/8 x 13/16	
7	3/4 x 5/8	7/8 x 13/16	
8	11/16 x 11/16	11/16 x 5/8	
9	5/8 x 5/8	5/8 x 5/8	
10	9/16 x 1/2	9/16 x 9/16	
11	9/16 x 1/2	9/16 x 1/2	
12	7/16 x 7/16	7/16 x 7/16	
13	7/16 x 3/8	7/16 x 9/16	
14	7/16 x 3/8	3/8 x 5/16	
15	7/16 x 3/8	3/8 x 3/8	
16	3/8 x 3/8	3/8 x 3/8	
17	1/2 x 7/16	9/16 x 1/2	
18	7/16 x 7/16	13/16 x 3/4	
19	15/16 x 7/8		

T153 - ST17-3

1			Spike left in No. 1.
2	2-3/4 x 1-1/2	1-3/8 x 1-3/16	
3	1-5/8 x 1-1/4	1-1/8 x 1-1/16	Jet in No.6 - 2-11/16" \perp ent.; 3-1/8 \perp exit.
4	1-3/16 x 1-3/16	1-3/16 x 1-1/16	
5	1-1/8 x 1-1/16	1-1/16 x 1	
6	1-1/16 x 1	15/16 x 15/16	Jet in No.20 - 1-1/4" \perp ent.
7	15/16 x 7/8	7/8 x 13/16	
8	1-1/16 x 7/8	1 x 3/4	

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PIATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
9	3/4 x 5/8	5/8 x 1/2	
10	5/8 x 1/2	5/8 x 5/8	
11	5/8 x 1/2	5/8 x 9/16	
12	5/8 x 9/16	5/8 x 5/8	
13	5/8 x 5/8	9/16 x 1/2	
14	9/16 x 1/2	5/8 x 9/16	
15	1/2 x 1/2	1/2 x 7/16	
16	7/16 x 7/16	9/16 x 1/2	
17	9/16 x 1/2	9/16 x 5/16	
18	1/2 x 7/16	5/8 x 1/2	
19	5/8 x 7/16	5/8 x 9/16	
20	3/4 x 5/8		

T153 - ST17-4

1			
2	1-3/4 x 1-3/8	1-3/4 x 1-3/8	Spike left in No.1.
3	1-3/8 x 1-1/4	1-3/8 x 1-1/4	
4	1-3/16 x 1-1/8	1-1/16 x 1-1/16	Jet in No.5 - 1-3/4" \perp
5	1-1/8 x 1-1/16	15/16 x 7/8	ent.; 2-3/4" \perp exit.
6	7/8 x 13/16	7/8 x 3/4	
7	3/4 x 11/16	3/8 x 3/8	Cu trace on ent.No.17.
8	11/16 x 3/8	11/16 x 3/8	
9	5/8 x 1/2	5/8 x 1/2	
10	9/16 x 1/2	3/8 x 9/16	
11	1/2 x 1/2	7/16 x 3/8	
12	9/16 x 1/2	5/8 x 1/2	
13	1/2 x 3/8	5/8 x 7/16	
14	9/16 x 1/2	1/2 x 7/16	
15	1/2 x 1/2	7/8 x 1/2	
16	3/4 x 3/4	5/16 x 7/16	
17			

T153 - ST17-5

1			
2	1-5/8 x 1-3/8	1-1/16 x 1-1/16	Spike left in No. 1.
3	1-1/8 x 1-1/8	1-1/8 x 1-1/16	
4	1-1/8 x 1-1/8	1-3/16 x 1-1/16	Jet in No.6 - 2-7/8" \perp
5	1-3/16 x 1-1/8	1-1/8 x 1-1/8	ent.; 2-3/4" \perp exit.
6	1-1/8 x 1	1 x 1	
7	7/8 x 7/8	13/16 x 3/4	Hole in ent.No.21 -
8	3/4 x 3/4	5/8 x 1/2	1/2" deep.
9	5/8 x 5/8	9/16 x 9/16	
10	9/16 x 9/16	9/16 x 9/16	
11	5/8 x 1/2	5/8 x 9/16	
12	9/16 x 9/16	1/2 x 1/2	

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PIATE NO.	HOLE MEASUREMENTS Diameter - Inches		OBSERVATIONS
	Entrance	Exit	
13	1/2 x 1/2	1/2 x 1/2	
14	1/2 x 7/16	9/16 x 1/2	
15	3/8 x 3/8	5/8 x 5/8	
16	7/16 x 7/16	1/2 x 1/2	
17	7/16 x 1/2	3/8 x 5/16	
18	3/8 x 3/8	3/8 x 5/16	
19	3/8 x 5/16	1/2 x 3/8	
20	1/2 x 3/8	5/8 x 5/8	
21	5/8 x 5/16		

T153 - ST18-1

1	1-3/4 x 1-5/8	2-3/8 x 2-1/8	
2	1-9/16 x 1-1/2	1-1/2 x 1-7/16	Jet in No.6 - 3-1/2" \perp
3	1-7/16 x 1-1/8	1-3/8 x 1-5/16	ent.; 1-7/8 \perp exit.
4	1-1/4 x 1-1/4	1-9/16 x 1-1/2	
5	1-1/8 x 1-1/16	1-1/8 x 1-1/16	Cu pile-up between No.7
6	1-3/16 x 1-1/8	1-1/4 x 1	and No.8; No.8 and No.9;
7	3/4 x 3/4	5/8 x 1/2	No. 9 and No. 10.
8	1/2 x 7/16	9/16 x 1/2	
9	5/8 x 5/8	5/8 x 1/2	Cu Trace on ent.No.19.
10	9/16 x 1/2	9/16 x 9/16	
11	9/16 x 1/2	9/16 x 9/16	
12	7/16 x 7/16	9/16 x 9/16	
13	1/2 x 7/16	9/16 x 7/16	
14	1/2 x 7/16	9/16 x 1/2	
15	9/16 x 1/2	5/8 x 7/16	
16	1/2 x 7/16	1/2 x 7/16	
17	7/16 x 7/16	5/8 x 9/16	
18	1/2 x 7/16	9/16 x 9/16	
19			

T153 - ST18-2

1	2-1/4 x 2-1/4	1-7/8 x 1-1/2	Indentation circumferential
2	1-3/4 x 1-9/16	1-3/8 x 1-5/16	to ent.hole No.1 - 3" x
3	1-1/8 x 1-1/8	1-3/16 x 1-1/8	3-7/16" x 3/16" deep.
4	1-1/8 x 1-1/16	1-1/8 x 1-1/16	
5	1-1/8 x 1	1 x 7/8	Jet in No.5 - 2-1/2 " \perp
6	13/16 x 3/4	7/8 x 13/16	ent.; 3" \perp exit.
7	3/4 x 3/4	11/16 x 11/16	
8	5/8 x 9/16	5/8 x 9/16	Jet in No.15 - 3/16" \perp
9	9/16 x 1/2	5/8 x 5/8	ent.; 1/2" \perp exit.
10	9/16 x 1/2	9/16 x 9/16	
11	9/16 x 7/16	5/8 x 9/16	Hole No.18 - 9/16" deep.
12	9/16 x 1/2	1/2 x 1/2	
13	1/2 x 1/2	1/2 x 5/16	

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
14	1/2 x 7/16	9/16 x 7/16	
15	9/16 x 9/16	9/16 x 1/2	
16	1/2 x 5/16	1/2 x 5/16	
17	1/2 x 1/2	5/8 x 9/16	
18	1/2 x 7/16		

T153 - ST18-3

1	2-5/16 x 2-3/8	1-1/4 x 1-1/8	
2	1-1/4 x 1-1/8	1-1/8 x 1-1/8	Part of spike flange
3	1-3/16 x 1-1/8	1-1/8 x 1-1/8	in hole No. 3.
4	1-1/4 x 1-3/16	1-1/16 x 1-1/16	
5	1 x 1	1-1/16 x 1-1/16	Jet in No.6 - 2-7/8" ⊥
6	1-1/16 x 1	1 x 1	ent.; 2-9/16" ⊥ exit.
7	15/16 x 7/8 -	13/16 x 3/4 -	
8	3/4 x 11/16	13/16 x 13/16	Jet in No.17 - 3/16" ⊥
9	5/8 x 9/16	11/16 x 5/8	ent.
10	5/8 x 9/16	11/16 x 5/8	Cu splash 1-3/8" x 1/2" x
11	5/8 x 9/16	9/16 x 9/16	1/16" deep between
12	9/16 x 1/2	11/16 x 5/8	No.18 and No. 19.
13	9/16 x 9/16	1/2 x 1/2	
14	9/16 x 1/2	1/2 x 1/2	
15	1/2 x 1/2	1/2 x 1/2	
16	1/2 x 1/2	5/8 x 9/16	
17	9/16 x 9/16	9/16 x 1/2	
18	5/8 x 9/16	11/16 x 5/8	
19			

T153 - ST18-4

1		1-7/8 x 1-3/4	Spike left in hole No. 1.
2	1-3/4 x 1-1/2	1-3/4 x 1-1/4	
3	1-1/4 x 1-1/8	1-3/16 x 1-1/8	
4	1-1/8 x 1-1/16	1 x 1	Jet in No.5 - 2-3/4" ⊥
5	1 x 1	7/8 x 13/16	ent.; 2-3/4" ⊥ exit.
6	7/8 x 7/8 -	13/16 x 13/16	
7	3/4 x 11/16	5/8 x 5/8	Jet in No. 9 - 7/16"
8	3/4 x 5/8	11/16 x 5/8	exit.
9	9/16 x 1/2	5/8 x 9/16	
10	9/16 x 7/16	9/16 x 9/16	Jet in No.12 - 5/8" ⊥
11	1/2 x 3/8	11/16 x 1/2	ent.
12	9/16 x 1/2	5/8 x 9/16	
13	1/2 x 1/2	9/16 x 7/16	Jet in No.18 - 3/8" ⊥
14	1/2 x 7/16	9/16 x 1/2	ent.
15	7/16 x 1/2	1/2 x 7/16	
16	7/16 x 7/16	1/2 x 7/16	Hole in No.18 - 5/16" deep.
17	7/16 x 7/16	1-3/16 x 7/8	
18	3/4 x 3/4		

CONFIDENTIAL

PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
T153 - ST18-5			
1	2-1/4 x 2-1/8	1-1/2 x 1-3/8	Indentation circumferential to No.1 ent. - 2-3/4" x 2-5/8"x 1/4" deep.
2	1-1/4 x 1-1/4	1-5/8 x 1-3/8	
3	1-1/2 x 1-3/8	1-1/8 x 1-1/8	
4	1-1/8 x 1-1/8	1-1/16 x 1	
5	1 x 7/8	1 x 1	Jet in No.6 - 3-3/4" \perp ent.
6	1 x 1	3/4 x 11/16	
7	11/16 x 5/8	11/16 x 5/8	Jet in No.16 - 3/4" \perp ent.
8	5/8 x 1/2	5/8 x 9/16	
9	9/16 x 1/2	9/16 x 9/16	Jet in No.18 - 3/8" \perp ent.
10	9/16 x 1/2	1/2 x 1/2	
11	9/16 x 7/16	9/16 x 9/16	
12	9/16 x 1/2	9/16 x 1/2	
13	9/16 x 1/2	5/8 x 9/16	
14	9/16 x 1/2	9/16 x 1/2	
15	1/2 x 7/16	1/2 x 1/2	
16	1/2 x 1/2	1/2 x 1/2	
17	5/16 x 3/8	3/4 x 11/16	
18	9/16 x 5/16		
T153 - ST19-1			
1	2-1/16 x 2	1-13/16 x 1-9/16	Jet in No.4 - 2-3/8" \perp ent.; 3" \perp exit.
2	1-5/16 x 1-5/16	1-3/8 x 1-1/4	
3	1-1/4 x 1-1/4	1-1/16 x 1-1/16	Steel splash between No. 7 and No. 8.
4	1 x 1	1-1/8 x 1-1/8	
5	15/16 x 7/8	7/8 x 13/16	Cu trace on No.19.
6	13/16 x 13/16	3/4 x 5/8	
7	3/4 x 5/8	5/8 x 5/8	
8	13/16 x 3/4	3/4 x 11/16	
9	5/8 x 5/8	5/8 x 5/8	
10	9/16 x 1/2	9/16 x 1/2	
11	9/16 x 1/2	9/16 x 1/2	
12	1/2 x 1/2	9/16 x 1/2	
13	1/2 x 7/16	9/16 x 9/16	
14	9/16 x 9/16	9/16 x 9/16	
15	9/16 x 1/2	1/2 x 1/2	
16	1/2 x 1/2	1/2 x 7/16	
17	1/2 x 7/16	1/2 x 3/8	
18	1/2 x 7/16	7/16 x 7/16	
19			


CONFIDENTIAL

PLATE NO.	HOLE MEASUREMENTS Diameter - Inches		OBSERVATIONS
	Entrance	Exit	
T153 - ST19-2			
1	1-7/8 x 1-1/2	1-5/8 x 1-1/2	Indentation 270° circum-ferential to hole No.1 ent. - 2"x 2"x 5/8" deep.
2	1-5/16 x 1-5/16	1-3/8 x 1-1/8	
3	1-1/8 x 1-1/8	1-1/8 x 1	
4	1 x 15/16	1 x 15/16	
5	13/16 x 13/16	15/16 x 7/8	Jet in No.1 - 3-1/8" ⊥ ent.; 2-1/4" ⊥ exit.
6	13/16 x 3/4	7/8 x 13/16	
7	3/4 x 11/16	3/4 x 3/4	
8	3/4 x 11/16	13/16 x 11/16	
9	11/16 x 5/8	3/4 x 11/16	Holes No.7 and No.8 are triangular.
10	11/16 x 9/16	11/16 x 9/16	
11	3/4 x 9/16	11/16 x 5/8	Jet in No.13 - 1/2" ⊥ exit.
12	11/16 x 11/16	3/4 x 9/16	
13	3/4 x 5/8	1/2 x 1/2	Hole in No.17 - 5/8" deep.
14	9/16 x 1/2	3/8 x 3/8	
15	3/8 x 1/4	1/2 x 7/16	
16	5/8 x 1/2	5/8 x 9/16	
17	3/8 x 3/8		
T153 - ST19-3			
1	1-9/16 x 1-3/8	2 x 1-3/4	Jet in No.3 - 3-1/2" ⊥ ent.; 1-3/4 ⊥ exit.
2	1-1/2 x 1-3/8	1-1/4 x 1-1/4	
3	1-1/4 x 1-1/4	1-1/8 x 1-1/8	Jet in No.13 - 1/4" ⊥ exit.
4	1 x 1	1-1/8 x 1-1/16	
5	7/8 x 7/8	1-1/16 x 15/16	Cu splash between No.15 and No.16.
6	13/16 x 3/4	15/16 x 7/8	
7	3/4 x 3/4	7/8 x 7/8	Hole in No.16 - 1/4" deep.
8	5/8 x 9/16	15/16 x 3/4	
9	11/16 x 5/8	3/4 x 11/16	
10	5/8 x 9/16	11/16 x 5/8	
11	5/8 x 5/8	5/8 x 5/8	
12	5/8 x 5/8	5/8 x 5/8	
13	11/16 x 5/8	1/2 x 1/2	
14	1/2 x 1/2	5/8 x 1/2	
15	5/8 x 1/2	5/8 x 1/2	
16	1/2 x 1/2		
T153 - ST19-4			
1	2-7/16 x 2	1-7/8 x 1-3/4	Spike left in No. 1 hole.
2	1-1/2 x 1-3/8	1-1/4 x 1-3/16	
3	1-3/8 x 1-5/16	1-1/4 x 1-1/8	Jet in No.2 - 3-7/8" ⊥ ent.; 2-7/16" ⊥ exit.
4	1-3/16 x 1-1/16	1-1/8 x 1-1/16	
5	1-1/8 x 1-1/16	1 x 1	Cu in holes No.9 and No. 10.
6	15/16 x 7/8	15/16 x 7/8	
7	15/16 x 13/16	13/16 x 11/16	
8	11/16 x 5/8	3/4 x 5/8	

B-13

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
9	11/16 x 11/16	5/8 x 5/8	Jet in No.11 - 1/4" 
10	11/16 x 5/8	9/16 x 1/2	
11	9/16 x 1/2	3/8 x 9/16	
12	5/8 x 1/2	9/16 x 1/2	Cu splash between No.16 and No.17.
13	5/8 x 1/2	5/8 x 1/2	
14	5/8 x 9/16	1/2 x 7/16	
15	7/16 x 7/16	1/2 x 3/8	
16	3/8 x 3/8	1/4 x 1/8	
17	5/8 x 3/8		

T153 - ST19-5

1	1-5/8 x 1-5/8	1-7/16 x 1-3/8	Jet in No.5 - 2-9/16" \perp ent.; 3" \perp exit.
2	1-5/16 x 1-3/16	1-1/4 x 1-1/8	
3	1-1/4 x 1-3/16	1-3/16 x 1-1/16	Cu in holes No.15 and No.16.
4	1 x 1	1-1/16 x 1	
5	1 x 15/16	1 x 1-1/16	Jet in No.17 - 1/4" \perp ent.
6	1 x 7/8	13/16 x 3/4	
7	3/4 x 3/4	3/4 x 11/16	Hole in No.17 - 1/4" deep.
8	11/16 x 5/8	3/4 x 11/16	
9	11/16 x 9/16	11/16 x 5/8	
10	11/16 x 5/8	5/8 x 5/8	
11	9/16 x 1/2	5/8 x 5/8	
12	9/16 x 1/2	9/16 x 1/2	
13	1/2 x 7/16	1/2 x 7/16	
14	1/2 x 1/2	11/16 x 5/8	
15	5/8 x 9/16	5/8 x 9/16	
16	9/16 x 1/2	11/16 x 5/8	
17	5/8 x 5/8		

T153 - ST20-1

1	1-3/4 x 1-9/16	1-5/8 x 1-9/16	Jet in No.6 - 2-9/16" \perp ent.; 3-1/8" \perp exit.
2	1-13/16 x 1-5/8	1-3/8 x 1-3/8	
3	1-1/4 x 1-1/4	1-3/8 x 1-3/8	Hole in No.18 - 1/8" deep.
4	1-3/8 x 1-5/16	1-1/4 x 1-1/4	
5	1-3/16 x 1-1/8	1-3/8 x 1-3/8	
6	1-1/8 x 1	1 x 15/16	
7	7/8 x 7/8	15/16 x 1	
8	3/4 x 3/4	7/8 x 3/4	
9	5/8 x 9/16	7/8 x 11/16	
10	9/16 x 9/16	5/8 x 9/16	
11	9/16 x 1/2	5/8 x 9/16	
12	1/2 x 1/2	5/8 x 5/8	
13	9/16 x 9/16	1/2 x 9/16	
14	1/2 x 7/16	1/2 x 1/2	
15	7/16 x 7/16	7/16 x 3/8	

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
16	3/8 x 3/8	11/16 x 1/2	
17	5/8 x 1/2	1 x 7/8	
18	13/16 x 5/8		

16	3/8 x 3/8	11/16 x 1/2
17	5/8 x 1/2	1 x 7/8
18	13/16 x 5/8	

T153 - ST20-2

1	2-1/4 x 2-1/8	2 x 1-3/4
2	1-7/8 x 1-1/2	2 x 1-3/4
3	1-1/2 x 1-3/8	1-5/16 x 1-1/4
4	1-5/16 x 1-5/16	1-1/8 x 1-1/8
5	1-1/8 x 1-1/8	1-1/4 x 1-1/16
6	1-3/16 x 1-3/16	1-1/4 x 1
7	1 x 7/8	13/16 x 3/4
8	13/16 x 11/16	3/4 x 3/4
9	3/4 x 3/4	1 x 13/16
10	13/16 x 9/16	3/4 x 3/4
11	5/8 x 9/16	11/16 x 9/16
12	5/8 x 9/16	9/16 x 9/16
13	9/16 x 1/2	9/16 x 9/16
14	9/16 x 1/2	9/16 x 1/2
15	1/2 x 7/16	1/2 x 1/2
16	5/8 x 1/2	13/16 x 3/4
17	5/8 x 11/16	

Jet in No.6 - 2-1/4" \perp
ent.; 3" \perp exit.

Jet in No.17 - 9/16" \perp
ent.

Hole in No.17 - 1/4"
deep.

T153 - ST20-3

1	3-1/4 x 2	2-1/8 x 1-7/8
2	1-3/8 x 1-5/16	1-3/8 x 1-5/16
3	1-3/16 x 1-1/8	1-3/16 x 1-3/16
4	1-1/8 x 1-1/8	1-1/16 x 1-1/16
5	1-1/8 x 1	1 x 1
6	7/8 x 7/8	13/16 x 13/16
7	3/4 x 11/16	13/16 x 5/8
8	5/8 x 5/8	11/16 x 5/8
9	5/8 x 5/8	3/4 x 11/16
10	5/8 x 5/8	5/8 x 9/16
11	9/16 x 9/16	5/8 x 5/8
12	1/2 x 1/2	5/8 x 9/16
13	1/2 x 7/16	9/16 x 1/2
14	1/2 x 7/16	9/16 x 9/16
15	7/16 x 3/8	1/2 x 7/16
16	1/2 x 7/16	1/2 x 3/8
17	1/2 x 7/16	7/16 x 3/8
18	7/16 x 5/16	7/16 x 3/8
19	7/16 x 3/8	3/4 x 3/8
20	5/8 x 7/16	1 x 1
21	3/4 x 3/4	

Indentation on one side
of hole ent.No. 1 -
2-1/2" x 1-3/16" x 1/4"
deep.

Jet in No.5 - 2-7/16" \perp
ent.; 3-5/16" \perp exit.

Jet in No.21 - 3/16" \perp
ent.

Hole in No.21 - 1/4" deep.

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PLATE NO.	HOLE MEASUREMENTS		OBSERVATIONS
	Diameter - Inches		
	Entrance	Exit	
<u>T153 - ST20-4</u>			
1	2-1/8 x 1-7/8	1-3/4 x 1-3/4	Jet in No.6 - 2-1/4" \perp ent.; 3" \perp exit.
2	1-3/8 x 1-3/8	1-1/2 x 1-1/2	
3	1-1/4 x 1-1/4	1-3/8 x 1-5/16	
4	1-1/8 x 1	1-1/8 x 1-1/8	Steel splatter 1/4" thick between No.9 and No. 10. Hole in No.18 - 1/2" deep.
5	1 x 1	1-3/16 x 1-1/8	
6	1-1/8 x 7/8	1 x 15/16	
7	1 x 7/8	1 x 1	
8	7/8 x 11/16	7/8 x 3/4	
9	7/8 x 3/4	3/4 x 3/4	
10	3/4 x 3/4	3/4 x 3/4	
11	5/8 x 1/2	5/8 x 9/16	
12	5/8 x 9/16	5/8 x 9/16	
13	1/2 x 7/16	1/2 x 1/2	
14	3/8 x 7/16	1/2 x 1/2	
15	7/16 x 3/8	1/2 x 7/16	
16	7/16 x 3/8	9/16 x 1/2	
17	7/16 x 3/8	1/2 x 3/8	
18	3/8 x 1/4		
<u>T153 - ST20-5</u>			
1	2-1/2 x 2	2-3/16 x 1-3/4	Indentation circumferential to ent.No.1 - 4-1/2" x 4" x 3/8" deep.
2	1-9/16 x 1-3/8	1-9/16 x 1-1/2	
3	1-3/8 x 1-3/8	1-1/2 x 1-1/2	
4	1-1/2 x 1-7/16	1-1/2 x 1-7/16	Jet in No.6 - 2-7/8" \perp ent.; 2-1/4" \perp exit.
5	1-1/4 x 1-1/4	1-1/4 x 1-3/16	
6	1-1/8 x 1-1/8	1 x 7/8	
7	3/4 x 3/4	1 x 1	Steel splash between No.8 and No.9.
8	5/8 x 9/16	3/4 x 3/4	
9	3/4 x 5/8	3/4 x 11/16	
10	9/16 x 1/2	9/16 x 9/16	Jet in No.17 - 1/2" \perp ent.
11	1/2 x 1/2	1/2 x 1/2	
12	7/16 x 7/16	1/2 x 1/2	
13	7/16 x 5/16	9/16 x 7/16	
14	3/8 x 3/8	9/16 x 3/8	
15	9/16 x 7/16	7/16 x 1/2	
16	1/2 x 7/16	9/16 x 1/2	
17	7/16 x 1/2		

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APPENDIX C

ASST-P.A. DOVER, N.J.
00000-42 7-20-56 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85575

T.P.R. NO.	KIND	Shell, 120MM, HEAT, Static Test T153 ST-14			AMM. LOT NO.
SPEC. NO.					PA-E-25553
					QUANTITY IN LOT
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
WBSK-1342	2-7-57	*			
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze, lucky and wire assemblies omitted. Accepted based on satisfactory local inspection. AND

COMPONENT	Metal Parts	Chg				
KIND	Assy	Bursting				
		Comp. B				
DRG. NO.	unk					
DATE OR REV.	unk					
MFG'D BY	Dudd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-14	HOL-7-1435				

PREPARED BY D. Scoble CERTIFIED TO BY: W. Knapp INSPECTOR
Ars Opers DIVISION PICATINNY ARSENAL 816 Inspection DIVISION
DOVER, NEW JERSEY

EXPERIMENTAL AMMUNITION DATA CARD No. 85575 - LOT NO. PA-E-25553

ASST-P.A. DOVER, N.J.
00000-42 7-20-56 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85576

T.P.R. NO.	KIND	Shell, 120MM, HEAT, Static Test T153 ST-15			AMM. LOT NO.
SPEC. NO.					PA-E-25554
					QUANTITY IN LOT
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
WBSK-1342	2-7-57	*			
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze, Lucky and wire assemblies omitted. Accepted based on satisfactory local inspection. AND

COMPONENT	Metal	Chg				
KIND	Parts	Bursting				
	Assy	Comp. B				
DRG. NO.	unk					
DRG. DATE OR REV.	unk					
MFG'D BY	Dudd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-15	HOL-7-1435				

PREPARED BY D. Scoble CERTIFIED TO BY: W. Knapp INSPECTOR
Ars Opers DIVISION PICATINNY ARSENAL 816 Inspection DIVISION
DOVER, NEW JERSEY

EXPERIMENTAL AMMUNITION DATA CARD No. 85576 - LOT NO. PA-E-25554

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ARMY-P.A. DOVER, N.J.
DDFORM-43 7-55-55 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85577

T.P.R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, 120MM, HEAT Static Test T153 ST-16				PA-E-25555
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN LOT
WBSK-1342	2-7-57	*			5
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	June, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze and Lucky assemblies omitted. Accepted based on satisfactory local inspection. X-rayed shell No. 16-5 contains foreign material in spike nose.

COMPONENT	Metal Parts	Charge				
KIND	Assy	Bursting				
DRG. NO.	unk	Comp. B				
DRG. DATE OR REV.	unk					
MFG'D BY	Budd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-16	HOL-7-1435				

PREPARED BY D. Scoble
Ars Opers
DIVISION

CERTIFIED TO BY: W. Trevena
Inspection
PICATINNY ARSENAL
DOVER, NEW JERSEY
DIVISION

EXPERIMENTAL AMMUNITION DATA CARD NO. 85577 - LOT NO. PA-E-25555

ARMY-P.A. DOVER, N.J.
DDFORM-43 7-55-55 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85578

T.P.R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, 120MM, HEAT Static Test T153 ST-17				PA-E-25556
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN LOT
WBSK-1342	2-7-57	*			
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze and Lucky assemblies omitted. Accepted based on satisfactory local inspection. X-RAYED SHELL NO. 17-4 CONTAINS FOREIGN MATERIAL IN SPIKE NOSE

COMPONENT	Metal	Chg				
KIND	Parts	Bursting				
	Assy	Comp. B				
DRG. NO.	unk					
DRG. DATE OR REV.	unk					
MFG'D BY	Budd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-17	HOL-7-1435				

PREPARED BY D. Scoble
Ars Opers
DIVISION

CERTIFIED TO BY: W. Knapp
Inspection
PICATINNY ARSENAL
DOVER, NEW JERSEY
DIVISION

EXPERIMENTAL AMMUNITION DATA CARD NO. 85578 - LOT NO. PA-E-25556

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ARMY-P.A. DOVER, N.J.
ORDER-43 7-24-56 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85579

T.P.R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, 120MM, HEAT Static Test T153 ST-18				PA-E-25557
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN LOT
WBSK-1342		*			3
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and dia 1.26" \pm .04". Fuze, Lucky and wire assemblies omitted. Accepted based on satisfactory local inspection. *ADD*

COMPONENT	Metal Parts	Charge				
KIND	Assy	Bursting Comp. B				
DRG. NO.	unk					
DRG. DATE OR REV.	unk					
MFGD BY	Budd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-18	HOL-7-1435				

PREPARED BY D. Scoble CERTIFIED TO BY: W. Trevora INSPECTOR
Ars Opers DIVISION PICATINNY ARSENAL 816 Inspection DIVISION
DOVER, NEW JERSEY

EXPERIMENTAL AMMUNITION DATA CARD NO. 85579 - LOT NO. PA-E-25557

ARMY-P.A. DOVER, N.J.
ORDER-43 7-24-56 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85580

T.P.R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Shell, 120MM, HEAT, Static Test, T153 ST-19				PA-E-25558
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAD OR EPO NO.	QUANTITY IN SHIPMENT
WBSK-1342	2-7-54				
P.A.X.O.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-19-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze, Lucky and wire assemblies omitted. Accepted based on satisfactory local inspection. *X-RAYED SHELL NO. 19-4 CONTAINS FOREIGN MATERIAL IN SPIKE AREA*

COMPONENT	Metal	Chg				
KIND	Parts	Bursting Comp. B				
DRG. NO.	unk					
DRG. DATE OR REV.	unk					
MFGD BY	Budd Wheel Co.	Holston				
DATE	1957	1955				
LOT NO.	ST-19	HOL-7-1435				

PREPARED BY D. Scoble CERTIFIED TO BY: W. Krapp INSPECTOR
Ars Opers DIVISION PICATINNY ARSENAL 816 Inspection DIVISION
DOVER, NEW JERSEY

EXPERIMENTAL AMMUNITION DATA CARD NO. 85580 - LOT NO. PA-E-25558

CONFIDENTIAL

ARMY-P.A. DOVER, N.J.
ORD 55-43 7-10-55 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85581

T.P.R. NO.	KIND				AMM. LOT NO.
PEC. NO.	Shell, 120MM, HEAT Static Test T153 ST-20				PA-E-25559
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAO/OP EPO NO.	QUANTITY IN LOT
WBSK-1342	2-7-57				
P.A.X.C.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 2 Shell/saddle packed/wood box.
*70304111-10-40069-01. X-rayed 100%. Fuze cavity drilled to a depth of 2.24" \pm .03" and 1.27" \pm .03" dia. Fuze Lucky and wire assemblies omitted. Accepted based on satisfactory local inspection.

COMPONENT						
KIND	Metal		Chr			
	Parts Assy		Bursting			
			Comp. B			
DRG. NO.	Unk					
DRG. DATE OR REV.	unk					
MFG'D BY	Rudd Wheel Co.		Holston			
DATE	1957		1955			
LOT NO.	ST-20		HOL-7-1435			

PREPARED BY D. Scoble CERTIFIED TO BY: W. Knapp INSPECTOR:
Ars Opers DIVISION PICATINNY ARSENAL DOVER, NEW JERSEY Inspection DIVISION

EXPERIMENTAL AMMUNITION DATA CARD NO. 85581 - LOT NO. PA-E-25559

ARMY-P.A. DOVER, N.J.
ORD 55-43 7-10-55 500

EXPERIMENTAL AMMUNITION DATA CARD

NO. 85754

T.P.R. NO.	KIND				AMM. LOT NO.
SPEC. NO.	Tetryl Pellets				PA-E-25674
DRG. NO.	DRG. DATE OR REV.	ALLOT. ADVICE	PROJECT NO.	RAO/OP EPO NO.	QUANTITY IN LOT
None					35
P.A.X.C.	PROP. CHARGE	EXPECTED M.V.	EXPECTED PRESSURE	ASSEMBLED BY	DATE OF ASSEMBLY
3034-64				PA	May, 1957

REMARKS: Packed: 18 Pellets/wrapped in commercial kraft paper and 17 pellets wrapped in commercial kraft paper/wood box/overpacked.
Dia. 1.25" \pm .03".
Height .500 \pm .03
Density GM/CC 1.55

COMPONENT						
KIND	Tetryl					
DRG. NO.						
DRG. DATE OR REV.						
MFG'D BY	Alabama					
DATE	1945					
LOT NO.	ALA-956					

PREPARED BY D. Scoble CERTIFIED TO BY: W. Knapp INSPECTOR:
Ars Opers DIVISION PICATINNY ARSENAL DOVER, NEW JERSEY Inspection DIVISION

EXPERIMENTAL AMMUNITION DATA CARD NO. 85754 - LOT NO. PA-E-25674

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